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THE ASTROBIOLOGY EXPLORER (ABE) MIDEX

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ABSTRACT

The Astrobiology Explorer (ABE) is a MIDEX mission concept currently being supported by NASA's Ames Research Center. The Astrobiology Explorer will utilize techniques of infrared spectroscopy to address outstanding problems in Astrochemistry which are particularly relevant to Astrobiology and are addressable via astronomical observation. The observational program would make fundamental scientific progress in each of the following key chosen areas:

1 - Cosmic History of Molecular Carbon
2 - Distribution of Organic Compounds in the Diffuse Interstellar Medium
3 - Tracing the Chemistry of Complex Organic Molecules in the Interstellar Medium
4 - Evolution of Ices and Organic Matter in Young Planetary Systems
5 - Deuterium Enrichments in Ices, PAHs, and Diffuse Medium Organic Refractory Materials

Fundamental progress can be made in all of these areas by conducting a coordinated set of infrared spectroscopic observations of approximately 1000 galaxies, stars, planetary nebulae, and young star / planetary systems. These observations require a sensitive observatory above the Earth's atmosphere. There are currently no other existing or planned facilities which have given adequate scientific priority to such observations and which could complete our observing program within their mission lifetimes. A dedicated mission would allow us to optimize mission design to obtain the best data possible for the investigation.

Our observational program could be accomplished in approximately 1 year of observations with a relatively modest, dedicated space observatory. For the purposes of estimating observing time, we have modeled such a mission as consisting of a 40 cm aperture (primary mirror) which is passively cooled to $T < 65$ K and equipped with a series of spectrographs that cover the mid-infrared from about 2.5 to 20 microns. This wavelength region is of particular interest to Astrobiology since it spans the vast majority of frequencies associated with the interatomic vibrations in organic compounds. The instrument would require a modest amount of cryogen in order to cool its detectors to operating temperature. The spacecraft would need to be in a low-background orbit to minimize its heat loading from the Earth. We believe that such an observatory could be built within the Medium Explorer (MIDEX) bounds (e.g. $140M FY98 cost cap). The next MIDEX AO is expected to be released in June 2000 for launches in 2005 and 2006.